

Attorney Docket No.: 0180144

**REMARKS**

Prior to the present amendment, claims 1-3, 6-7, 9-10, 13, 15-16, and 19 were pending in the present application. By the present amendment and response, claims 1, 9, 15, and 19 have been amended and claim 16 has been canceled. Thus, claims 1-3, 6-7, 9-10, 13, 15, and 19 remain in the present application. Reconsideration and allowance of pending claims 1-3, 6-7, 9-10, 13, 15, and 19 in view of the above amendments and the following remarks are requested.

Applicant has received a final Decision On Appeal dated September 24, 2008 from the Board of Patent Appeals and Interferences (hereinafter the "Board"). Applicant hereby requests that the prosecution of the present application be reopened under provisions of 37 CFR §1.198 and MPEP §1214.07, which permit the Applicant to reopen prosecution by submitting a request for continued examination (RCE) under 37 CFR §1.114. Accordingly, Applicant respectfully requests that the currently amended claim be entered in the present application. Applicant submits that pending claims 1-3, 6-7, 9-10, 13, 15, and 19 are patentably distinguishable over the art of record, and respectfully requests that claims 1-3, 6-7, 9-10, 13, 15, and 19 be examined for an early allowance in the present application.

**A. Rejection of Claims 1-3, 6, 9-10, and 15-16 under 35 USC §102(b)**

The Examiner has rejected claims 1-3, 6, 9-10, and 15-16 under 35 USC §102(b) as being anticipated by U.S. Patent Number 6,190,975 to Kubo et al. (hereinafter "Kubo"). For the reasons discussed below, Applicants respectfully submit that the

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present invention, as defined by amended independent claims 1, 9, and 15, is patentably distinguishable over Kubo.

The present invention, as defined by amended independent claim 1, requires a first gate dielectric having a first coefficient of thermal expansion and a first gate electrode having a second coefficient of thermal expansion, where the first gate dielectric is selected to have the first coefficient of thermal expansion and the first gate electrode is selected to have the second coefficient of thermal expansion so as to cause a strain in the channel, thereby increasing carrier mobility in the FET. As disclosed in the present application, in one embodiment of the present invention, FET 102 including gate electrode layer 114, gate dielectric layer 116, and channel 112, where gate dielectric layer 116 is situated over channel 112 and gate electrode layer 114 is situated over gate dielectric layer 116. *See, e.g., Figure 1 and related text of the present application.*

As disclosed in the present application, gate electrode layer 114 and gate dielectric layer 116 can be selected such that gate electrode layer 114 has a coefficient of thermal expansion (CTE) that is higher than a CTE of gate dielectric layer 116. *See, e.g., page 7, lines 7-9 of the present application.* As a result, as a wafer comprising structure 100 cools down after gate electrode layer 114 has been deposited at high temperature, gate electrode layer 114 decreases in size to a greater extent (i.e. shrinks more) than gate dielectric layer 116. *See, e.g., page 7, lines 9-12 of the present application.* Consequently, tensile strain is created in channel 112, which advantageously increases carrier mobility in FET 102. *See, e.g., page 7, lines 12-13 of the present application.* In an embodiment in which FET 102 is a PFET, gate dielectric

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layer 116 and gate electrode layer 114 are selected such that gate dielectric layer 116 has a CTE that is higher than a CTE of gate electrode layer 114 so as to create compressive strain in channel 112, which advantageously increases carrier mobility in the PFET.

*See, e.g., page 7, lines 13-17 and Figure 1 of the present application.*

In contrast to the present invention as defined by amended independent claim 1, Kubo does not disclose a first gate dielectric having a first coefficient of thermal expansion and a first gate electrode having a second coefficient of thermal expansion, where the first gate dielectric is selected to have the first coefficient of thermal expansion and the first gate electrode is selected to have the second coefficient of thermal expansion so as to cause a strain in the channel, thereby increasing carrier mobility in the FET. Kubo specifically discloses a heterostructure CMOS (HCMOS) device including NMOS and PMOS transistors, which are formed on silicon substrate 10. *See, e.g., Figure 1 and related text of Kubo.*

In Kubo, the NMOS transistor, which has a substantially similar structure as the PMOS transistor, includes gate electrode 18n, gate insulating layer 19n, Si layer 17n, SiGe layer 15n, and SiGeC layer 14, where a carrier accumulation layer formed in the vicinity of the interface at the side of SiGeC layer 14n serves as a channel in which electrons travel at a high speed. *See, e.g., column 9, lines 1-6 and lines 24-25 and Figure 1 and related text of Kubo.* In Kubo, the electron mobility is higher in SiGeC layer 14n than in the Si layer, thus increasing the operational speed of the NMOS transistor. *See, e.g., column 9, lines 4-6 of Kubo.* In the HCMOS device disclosed in an embodiment in Kubo, the composition rates of Si, Ge, and C in the SiGeC layer (e.g., SiGeC layer 14n)

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can be adjusted such that the band gap amount and lattice misfit with respect to silicon can be changed. *See, e.g.*, column 10, lines 18-22 of Kubo.

However, Kubo fails to disclose a first gate dielectric having a first coefficient of thermal expansion and a first gate electrode having a second coefficient of thermal expansion, where the first gate dielectric is selected to have the first coefficient of thermal expansion and the first gate electrode is selected to have the second coefficient of thermal expansion so as to cause a strain in the channel, as specified in amended independent claim 1. Also, Kubo fails to mention any relationship between a CTE of gate electrode 18n and a CTE of gate insulating layer 19n. In fact, Kubo fails to even mention a CTE of gate electrode 18n or a CTE of gate insulating layer 19n.

On pages 2 and 3 of the Final Rejection of March 3, 2005, the Examiner cites *Silicon Processing for the VLSI Era*, Vol. 1, by Wolf et al. (hereinafter "Wolf") for the teaching that "the coefficient of thermal expansion depends on the material (see Exhibit A, Wolf et al.)." Applicants do not dispute the teachings of Wolf. However, Wolf fails to mention a first gate dielectric having a first coefficient of thermal expansion and a first gate electrode having a second coefficient of thermal expansion, where the first gate dielectric is selected to have the first coefficient of thermal expansion and the first gate electrode is selected to have the second coefficient of thermal expansion so as to cause a strain in the channel, as specified in amended independent claim 1. Therefore, Applicants submit that Wolf fails to cure the aforementioned deficiencies of Kubo.

For all the foregoing reasons, Applicants respectfully submit that, at the time the invention defined by amended independent claim 1 was made, the invention would not

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have been obvious to a person of ordinary skill in the art by Kubo. Thus, amended independent claim 1 is patentably distinguishable over Kubo and, as such, claims 2-3 and 6-7 depending from amended independent claim 1 are, *a fortiori*, also patentably distinguishable over Kubo for at least the reasons presented above and also for additional limitations contained in each dependent claim.

Amended independent claims 9 and 15 include similar limitations as amended independent claim 1. Thus, for similar reasons as discussed above, amended independent claims 9 and 15 are patentably distinguishable over Kubo. As such, claims 10 and 13 depending from amended independent claim 9 and claim 19 depending from amended independent claim 15 are also patentably distinguishable over Kubo for at least the reasons presented above and also for the additional limitations contained in each dependent claim.

**B. Rejection of Claims 7, 13, and 19 under 35 USC §103(a)**

The Examiner has rejected claims 7, 13, and 19 under 35 USC §103(a) as being unpatentable over Kubo. As discussed above, amended independent claims 1, 9, and 15 are patentably distinguishable over Kubo. Thus claim 7 depending from amended independent claim 1, claim 13 depending from amended independent claim 9, and claim 19 depending from amended independent claim 15 are, *a fortiori*, also patentably distinguishable over Kubo for at least the reasons presented above and also for additional limitations contained in each dependent claim.

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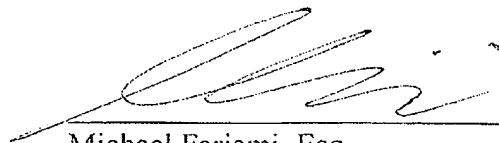
**C. Conclusion**

For all the foregoing reasons pending claims 1-3, 6-7, 9-10, 13, 15, and 19 are patentably distinguishable over the cited art, and an early allowance of pending claims 1-3, 6-7, 9-10, 13, 15, and 19 is respectfully requested.

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Respectfully Submitted,  
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